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Skills and Smart Specialisation

*The role of Vocational
Education and Training
in Smart Specialisation
Strategies*

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Abstract

The Smart Specialisation approach has been part of EU regional innovation policy since 2010 and yet the role of skills and vocational education and training in implementing Smart Specialisation Strategies has only recently attracted attention. Despite being raised in earlier policy documents, it was the 2017 Communication on *Strengthening Innovation in Europe's Regions*, drawing on experience of implementing smart specialisation in practice, which illustrated its significance for regional innovation policy. In the proposals for Cohesion Policy post 2020, education and skills for innovation are important priorities. Therefore, this technical report is timely since it explores trends in Vocational Education and Training (VET), looks at where it has contributed to Smart Specialisation in specific cases, and highlights elements to consider in regional strategies.

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Executive summary

Vocational Education and Training (VET) can play a much bigger role in Smart Specialisation Strategies than has so far been considered. This is because VET encompasses skill development as well as innovation diffusion and applied research – which together can have a more direct impact on sustainable economic growth, especially of less developed regions. VET also contributes to addressing the demographic challenges which Europe faces, responding to the needs for re-skilling and up-skilling through non-formal training and at different levels of formal VET. Indeed, VET is now offered by institutions across the post-secondary and short-cycle tertiary education landscape, corresponding to forecasts that predict a growing number of jobs in occupations requiring higher level of skills. Taking into account the existing differences across the EU, these ongoing demographic, labour market and technological changes present considerable challenges and opportunities for VET in order to meet the needs of an increasingly diverse cohort of learners of all ages and backgrounds, and the regions in which they are located.

The S3 Platform was established at the Joint Research Centre in 2011 to advise national and regional authorities on the design and implementation of their Smart Specialisation Strategies (S3), the most significant of the 'ex-ante conditionalities' of the European Structural and Investment Funds (ESIF) for the period 2014-2020. However, while S3 are economic transformation strategies that require a broad policy mix for success, ESIF spending has mostly been limited to the thematic objective for research and innovation. The JRC project on Targeted Support to Transitions in Regional Innovation Ecosystems (STRIVE) provides concrete support to regions in the implementation of their S3 and from October 2019 will include a work package on the role of higher VET in matching supply and demand for skills in regional labour markets. This technical report provides a first overview of the policy and academic literature to serve as the starting point for this work package. The main themes identified include the following:

- VET can play a more direct and dynamic role in the innovation eco-system – effectively VET-ising the ecosystem, by promoting and diffusing knowledge, especially related to process and service innovation.
- VET can also help build and generate absorptive capacity with skilled graduates that apply and synthesise knowledge across all technological areas and help renew competences in traditional sectors;
- VET should adopt the principles of smart specialisation to its own work – developing a strategic place-based approach to curriculum design, adding comparative value to the regional economy by developing programmes which build on local expertise, products and needs. This includes, inter alia, broadening partnerships with local business, service providers and industry associations, and establishing a network of vocational education institutes;
- To overcome fragmentation of provision in the post-secondary education system, there should be enhanced connectivity between VET and higher education/universities, including developing new governance arrangements;
- Governance cohesion is required to extend beyond the education system itself, requiring policy coherence through a whole-of-government and stakeholder engagement approach building-up institutional-thickness, which involves forming strong collaborative systems including educational institutions, enterprise, local/regional authorities and civil society;
- Some governments have also introduced accountability measures, including performance funding or compact systems, with funding attached to institutional response to national objectives, including labour market needs;
- We are in the “early stages of a learning revolution” involving new teaching and learning pedagogies and the use of technology in classrooms. Emphasis on skills

should be matched by growing understanding that people also require a wider range of competences; technical skills alone will not be sufficient in this rapidly changing world;

- Demographic changes across developed economies means that the relative importance of adult learning to the workforce is increasing to an extent where learning through life is no longer optional but essential for economic, social and personal development;
- VET has a particular role and social responsibility to work with disadvantaged communities and develop strategies and pathways by which people of all abilities, ages, ethnicities and talents can be guided through the education system to reach their full potential and contribute their skills, energies and commitment to wider society throughout their lives.

1 Introduction

The policy and academic literature on Smart Specialisation Strategies (S3) has often focused on the role played by universities and university-based research as a key driver of innovation and regional development. This is seen as providing the necessary cohort of skilled knowledge workers that can carry out R&D, commercialise intellectual property, and catalyse the adoption of research (e.g. Edwards, Marinelli, Arregui-Pabollet, & Kempton, 2017; Foray, Morgan, & Radošević, 2014).

However, society and the labour market have changed dramatically over recent decades and will continue to be transformed by the impact of the Fourth Industrial Revolution; people with knowledge and flexible skills will be needed in all sectors and occupations. Therefore, sustainable social and economic development in the future will ultimately rely on human capital in the broadest sense: graduates from all levels of education with the knowledge and entrepreneurial attitudes, skills and competences who are capable of creativity and critical thinking, initiative and independent action. This relates particularly to high quality VET, which has largely been neglected in education and training policies in many countries, but is increasingly being recognised as a vital part of a multi-faceted post-secondary education system. It has the capacity to support innovation by raising the overall productive capacity in high-tech as well as low-tech industries, and drive competitiveness and growth policies (European Commission, 2017c; Business Council of Australia, 2017; OECD, 2014a). As with those from higher education, VET graduates tend to enjoy better health and are more likely to be interested in politics and public affairs, participate actively in civil society, and be more trusting and supportive of other people. Democratic societies require an engaged citizenry.

This report focuses on the role and contribution of human capital, and specifically VET, to innovation and smart specialisation. It takes as its starting point that:

"Vocationally oriented education and training is something more than the traditional VET delivered at upper secondary level (in the form of school-based education or training, apprenticeships, or combinations of these). Due to the requirements of lifelong learning, we are able to observe diversification of VET with new institutions and stakeholders involved. We also see an expansion of VET to higher education areas, partly through reform of existing institutions, partly through the emergence of new institutions. This has been caused by factors internal to the education and training system as well as by external pressures linked to demographic, technological and economic changes" (Cedefop, 2017b, p. 1).

Following this introduction, section two identifies some macro-trends impacting on education systems and then considers the changing profile of vocational education and training (VET) in Europe and identifies some differences between EU Member States. Section three reviews the policy and academic literature with specific reference to links between VET and innovation and smart specialisation. Section four is the main analytic part of the report. It draws on the literature and experiences from different regions, and identifies some key issues and themes for boosting the role of VET in innovation and regional development. Finally, the conclusions provide a summary and suggestions for future policy development.

2 Changing Profile of Vocational Education and Training in Europe

2.1 Macro-Trends Impacting Vocation Education and Training

Globalisation alongside economic, demographic, climate change and technological developments are driving significant change in our societies. While the UN estimates the world population will rise to 9.7bn by 2050 and to 11.2bn by 2100 (Population Division 2015, p. 4), most of this growth is expected to occur in Africa. In contrast, across Europe, the population will decline after 2020 due to lower birth rates. In fact, for many countries across Europe, their population has been shrinking since 2012 (European Commission, 2016a). As a result of significant gains in life expectancy, the concept of “old age” is being redefined (ibid, p. 8). Those aged 65 years and over will increase from 18% of the European population to 28%, and those aged 80 and over will rise from 5% to 12%, by 2060. By then, the ratio of people working to the numbers retired will have changed dramatically. This means that the “EU would move from having about four working-age people for every person aged over 65 years to two working-age people” (European Commission, 2014, p. 2).

Nearly one-third of the world’s population (29.3%) is under 15 years old. Students worldwide are forecast to rise from about 4% of the population in 2012 to 10% by 2040. Across the EU, the proportion of people aged 30 to 34 with a tertiary qualification has risen steadily, from 22.4% in 2000 (EU 27) reaching 40.7% for the first time in 2018 (EU28), which surpasses the Europe 2020 target of 40% (European Commission, 2017a). There are however some national differences where the proportion of persons with tertiary education attainment was below 30%; 16 countries have already reached national targets (Eurostat, 2018a). Alongside expanding participation of more young adults into tertiary education, there has been increasing focus on widening access to socio-economic and other disadvantaged groups which have heretofore been under-served.

As people live actively for longer (Jagger, 2015), there is a necessity to expand life-long learning opportunities to cater for re-skilling and up-skilling requirements for people in the labour force or for those wishing to (re)join; the latter is especially significant for women after child-birth or rearing.

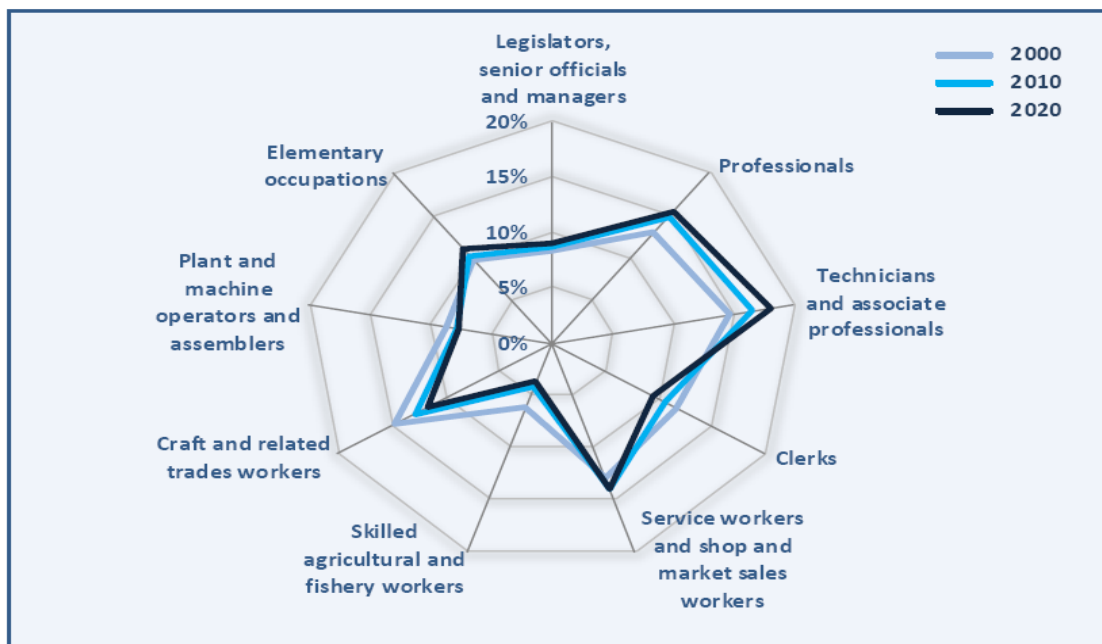
The Fourth Industrial Revolution is only beginning, but there is already strong evidence of its effects, with 43% of EU adult workers experiencing recent changes in the technologies and 47% experiencing changes in the methods used in their workplace (Cedefop, 2018a, p. 12). Big discoveries and innovations will span categories such as the Internet of Things; Big Data Analytics; Artificial Intelligence; Neurotechnologies; Nano/Microsatellites; Nanomaterials; Additive Manufacturing; Advanced Energy Storage Technologies; Synthetic Biology; and Blockchain; they will enhance human capabilities with a transformative effect on people’s patterns of life and work (OECD 2016b, pp. 77-126).

The regional impact of these socio-demographic changes is likely to vary considerably, with some regions better able to respond to opportunities and retain/enhance their attractiveness and thus sustainability. This will also depend upon policy and educational responses – without adequate action differences across regions are likely to intensify both in terms of labour market as well as personal outcomes (OECD, 2018a, 37-38). (See Box 5 about the Swedish Automotive Industry in Västra Götaland, which is responding to the effects of changing demographics).

In addition to the adage that people will work in jobs which we don’t even know about now, the workforce itself will become more diverse – with a greater range of ages, more women and more ethnic diversity. There will be an increasing emphasis on new skills – with numbers qualified at intermediate and high level projected to continue to rise as people and governments invest in high level qualifications (see Figure 1). The OECD has

reiterated: “the demand for individuals who possess a broader knowledge base, more specialised skills, advanced analytical capacities, and complex communications skills continues to rise” (OECD, 2012, p. 26). Yet, forecasts suggest that higher skills will constitute 41% of the skills mix required for 2030 compared with almost 45% of medium level skills (Cedefop, 2018b, p. 73).

Figure 1. Changing Occupational Structure of Employment, EU27, % change



Source: Cedefop, 2010

Digital transformation of the labour market is also progressing fast. Across the EU, 90% of future jobs will require some level of digital skills, yet 44% of EU people do not have basic digital skills, and 24% of working age population does not have an upper secondary education (European Commission, 2017c; Brunello & Wruuck, 2019; Vandeplas & Thumthysen, 2019). At the same time, 40% of European businesses can't find appropriate people to work for them (Thyssen, 2014). Sixty-five percent of children entering primary school today will work in occupations that don't currently exist (WEF, 2016, p.3).

These developments are transforming the way people live and work, and what, where, when and how they learn (Janta et al, 2015, p. 35-36). They correspond to a shift towards more flexible working, contract-based employment, and people changing jobs more frequently (ILO, 2015). Soft/generic or transversal skills, such as communication and language skills, teamwork and leadership, will be essential for effective professional interaction with others. These changes require more diverse and flexible education and lifelong learning opportunities¹ that can enable people to enhance their “employability” throughout their lives and sustain them through planned and unplanned changes in life circumstances. This means that the concept of a “job for life” is becoming as redundant as an “education for life”, and so life-long learning (LLL) is not just a reality but a necessity.

At the same time, high numbers of youth unemployment and graduate underemployment in the aftermath of the Great Recession have raised concerns about the employability of graduates and (re)training adults for employment. Public debate has taken different forms in different countries, but common concerns include: new graduates lack the skills

¹ Lifelong learning as defined by Eurostat includes “all purposeful learning activity, whether formal, non-formal or informal, undertaken on an ongoing basis with the aim of improving knowledge, skills and competence”.

that employers need; too many graduates study the wrong subjects for available jobs; and some graduates are stuck in low-skilled jobs or under-employed. There are also concerns about the appropriateness of the curriculum and mismatches between qualifications and deployment in the workplace, with questions being asked about whether graduates have the appropriate balance between practical skills, learning facts and critical thinking. Questions are being asked as to whether too many students are being (mis)directed towards academic-oriented university programmes rather than those which emphasize vocational/professional education and practical experience. In this context, VET also referred to as TVET (Technical Vocational Education and Training), is receiving renewed attention.

Implications arising from these developments include the following:

1. The combination of gains in life expectancy and the 4th Industrial Revolution means people need to be more flexible and adaptable throughout their lives. Adult learners are a critical part of the increasingly more diverse cohort of learners. In turn, the relationships between education and careers will change in profound ways. Basic vocational skills will no longer be enough. Employment-specific training must be accompanied by generic capabilities, such as problem solving, teamwork and communication skills.
2. As demographic change sweeps across Europe, there is a growing demand from previously under-served groups: low-income/socio-economic disadvantaged, the first-in-family², immigrants, and adults, for greater participation in the education system. There is also a necessity to include more groups in order to meet labour market demand as well as ensuring society is more inclusive and equitable. Accommodating all these learners requires a more diverse set of educational opportunities and programmes, and types of providers, both public and private, allowing much greater flexibility for learners to move in, and out, of the educational system as appropriate and required.
3. Regional vitality is dependent upon attracting and retaining high level human capital, especially outside global cities. Colleges and universities, as well as other post-secondary training provides with strong VET oriented curriculum tend to be located in smaller towns and cities and have a stronger link to their region and regional stakeholders. While most new jobs are in high-skilled industries, there is still a need for traditional middle skill jobs and for employment in ancillary sectors which contribute to making a town or city attractive. Ultimately, human capital is stickier than knowledge.

2.2 Changing Profile of Vocation Education and Training (VET)

The UNESCO Convention (1989), Article 1, describes vocational education and training as:

"All forms and levels of the education process involving, in addition to general knowledge, the study of technologies and related sciences, the acquisition of practical skills, know-how, attitudes and understanding relating to occupations in the various sectors of economic and social life".

Cedefop (2014, p. 292) similarly defines VET as:

"Education and training which aims to equip people with knowledge, know-how, skills and/or competences required in particular occupations or more broadly in the labour market"

VET usually helps learners apply technical skills and reflective competences to real problems in concrete situations by linking practical knowledge with theoretical

² In this context 'first-in-family' refers to a child entering a level of education in which their parents or siblings had not previously accessed.

understanding. The learning environment normally combines in-classroom learning with experiential learning at the workplace and/or through practice. VET is usually associated with occupation-related education and training, but this varies considerably across Europe; France, Italy, Croatia, Cyprus, Luxembourg and the Netherlands, for example, include broad occupational fields while others refer to occupation- and job-specific training (Cedefop, 2017c, p. 24; OECD, 2014, p. 3). In the latter context, apprenticeship is often seen as the “pure” form of vocational education and training because it directly combines learning with particular types of work. Ireland uses the term ‘further education and training’, which also includes adult literacy and community education.

Significantly, both UNESCO and Cedefop definitions associate VET with an education and pedagogical approach rather than a “...particular institutional type or qualification level. This not only reflects the existing diversity of VET solutions in different countries but leaves the door open for VET to be provided for a wide group of (lifelong) learners at any level and in a wide variety of institutions.” (Cedefop 2015).

Notably, a ruling by the Court of Justice of the European Communities in 1985 widened the definition of vocational training to include higher education, viz: “any form of education which prepares for a qualification for a particular profession...even if the training includes an element of general education” (European Commission 2006, p. 102).

In the 1970s, UNESCO developed the International Standard Classification of Education (ISCED) to compile and present education statistics nationally and internationally in a comparable way. Originally, there were clearer distinctions between practical/VET-oriented programmes and academic ones. With the focus on learning outcomes and more attention to matters of employability and relevance, many of these distinctions have blurred. At this moment, there is no internationally agreed definitions to distinguish between professional and academic degrees at bachelor level or above (OECD 2014). Indeed, practical elements can be included up to doctoral studies in universities of applied sciences. Table 1 below aligns ISCED (revised 2011) with the European Qualifications Framework (EQF).

The attitude to and provision of VET has varied across the EU because of the distinctiveness of national systems. In contrast to higher education which has traditionally been more clearly defined, VET provision ranges from countries with high standardisation, strong track differentiation and linkages between education and the labour market to countries with much weaker track differentiation and school to work linkages (McGuinness et al. 2014, p. 109). Germany, for example, has stressed parity of esteem between vocational and academic education (Cedefop 2017b, p. 24), whereas in other jurisdictions, such as the UK, social-cultural and policy factors have meant that VET has had a relatively low status and provision has not always been well-aligned with national social or economic policy needs (Wolf, Dominguez- Reig, & Sellen 2016; Moodie 2008). See example of the iWatermap: Interregional Cooperation, Netherlands with respect to trying to inspire greater interest in a technical career (Box 6).

Initial vocational education and training (I-VET) is usually provided at secondary/upper secondary level, before entering working life, with students making a decision during their mid-teen years. It takes place either in a school-based environment (with the majority of learning taking place in a class-room) or in a work-based setting, organised as close as possible to real-life experience (either in schools, training centres or companies, with apprenticeship schemes as the most typical example). In recent years, there has been a move towards greater flexibility with an increasing number of programmes offering dual qualifications, allowing students to proceed with a vocational or academic qualification. Table 1 draws a simple correspondence between ISCED and EQF albeit there are some differences in the way in which both classification systems describe skills and competences; in this way it provides a simple tool; the Bologna Framework refers only to undergraduate, graduate and doctoral studies.

Table 1. Comparing ISCED, EQF and Bologna, Tertiary Level

ISCED	EQF Levels	Bologna Framework	Description	Indicative Institutional Type
3	3	N/A	Programmes designed to complete secondary education in preparation for tertiary education or provide skills relevant for employment	Upper secondary education provided in secondary or vocational or other types of schools dependent on the country
4	4	N/A	Programmes which aim to provide individual acquisition of knowledge, skills and competencies to enable progression to tertiary education or for employment.	Post-secondary non-tertiary education, including vocational education
5	5	Short Cycle within First Cycle	Programmes designed to provide professional knowledge, skills and competencies; typically, practically based, occupationally-specific to prepare students to enter the labour market	Colleges for Higher Vocational Education, Schools for People in Employment, Add-on Courses, Post-secondary VET Courses and Master-Craftsperson, Foreperson and Construction Trades Courses
6	6	First Cycle	Bachelors' or equivalent: designed to provide intermediate academic and/or professional knowledge, skills and competencies, leading to a first degree	Universities, universities of applied sciences and university colleges of teacher education as well as comparable colleges/programmes
7	7	Second Cycle	Masters or equivalent: designed to provide advanced academic and/or professional knowledge, skills and competencies, leading to second degree or equivalence; typically, theoretically-based but may include practical components and informed by state-of-the-art research and/or best professional practice	Universities, universities of applied sciences and university colleges of teacher education as well as comparable colleges/programmes
8	8	Third Cycle	Doctorate or equivalent: designed to provide advanced theoretically-based qualification, informed by state-of-the-art research	Universities, universities of applied sciences and university colleges of teacher education as well as comparable colleges/programmes

Source: <https://ec.europa.eu/ploteus/en/content/descriptors-page>

VET is, increasingly, an integral part of tertiary or post-secondary / post-compulsory education systems, which includes higher education and universities but there is little consensus on where it fits within national systems (Ulicna, Messerer & Auzinger, 2016, p138).³ Many countries have a binary tertiary education system, with a dedicated set of institutions akin to universities but separate (often referred to as UaS or universities of applied science), e.g. Fachhochschulen or, university colleges in Scandinavia, Hogescholen in the Netherlands, polytechnics in Finland and institutes of technology in Ireland. In the UK and Ireland, Further Education (FE) colleges offer both upper-secondary and post-secondary non-tertiary direct entry to employment or pathways to higher education. These differ from the above-mentioned UaS or community colleges in the United States, both of which are predominantly tertiary institutions. Community colleges in the US mainly focus on workforce preparation, preparing students for their first job or retraining, upgrading, assisting owners of small businesses or helping communities with economic development planning (Dougherty, Lahr, & Morest, 2017, p. 2). In addition, these colleges provide a pathway to higher education, with 37% of students choosing to transfer from a two-year to a four-year college and almost 55% transferring in the opposite direction, in other words from a four-year to a two-year college (Shapiro et al., 2018). In some countries, dual-sector institutions have been established providing vocational/professional education from EQF levels 5-8, for example in Australia and Ireland. Germany has a well-established dual system of vocational education and training, which is distinct from its higher education/university system. Typically, there is an assumption that learners progress up-wards through the different EQF levels, whereas conversely, higher education students often seek VET qualifications for professional enhancement (Bogna, 2016). There is no common approach across the EU.

Focus on employability has had a transformative effect on policy and public thinking in many countries, and on curriculum and learning broadly. Higher level vocational qualifications, including professional bachelor degrees, have been the distinguishing and differentiating feature of universities of applied sciences (Camilleri, Delplace, Frankowicz, Hudak, & Tannhäuser, 2014). In contrast, universities traditionally were seen as teaching only academic disciplines despite the fact that over the years their biggest growth area has been in professional education, e.g. medicine, law, education, business, media, theatre and arts practice, etc. More recently, in response to policy and public and student pressure for programmes with greater labour market relevance, universities have underscored the importance of acquiring competences which enhance graduate employability through various approaches, including internships and work-based learning, as well as applied- and community-based research, within the curriculum – features which have proven to be extremely attractive. This has led to some blurring between UaS and university programmes.

These changes are affecting apprenticeship education, which, depending upon the country, have been traditionally provided in technical schools at secondary level, and operated in association with employers in construction, printing, automobiles, etc. However, apprenticeship education is being redesigned for the 21st century and being offered by a variety of education providers. These programmes retain the 'earn-learn' model but now pertain to a wider range of sectors including accountancy, retail, insurance, etc. The above-mentioned German apprenticeship "Dual System" involves training in both firms and public training systems. Developments in the UK and Ireland

³ New Zealand has adopted a broad definition of tertiary education, which: "includes learning at all levels within public tertiary institutions (i.e. polytechnics, universities, colleges of education and wānanga), programmes provided by private and government training establishments, business-based education, industry training, and all lifelong learning beyond the compulsory school system. It thus includes both formal and non-formal education, and what is often termed "second-chance" education. Embracing these diverse forms of education and training is particularly important if the challenges of promoting lifelong learning and designing a tertiary education system that contributes to the knowledge society are to be taken seriously." See TEAC (2000) *Shaping a Shared Vision. Initial Report of the Tertiary Education Advisory Commission*. Wellington, NZ: Tertiary Education Advisory Commission, p9. See <https://www.tec.govt.nz>

are extending apprenticeships education to new fields, with potential to extend to doctoral level.

Table 2. VET in the early 1990s compared with today

	Early 1990s	Mid 2010s
VET as formal part of the education system	Emerging from the fragmented provision of largely industry led training	A coherent system of VET fully integrated into national qualification systems (and made visible through national qualification frameworks)
Attractiveness of VET	Strong labour market relevance and attractiveness in some sectors, but overall limited attractiveness due to limited progression opportunities (VET as dead-end)	Still lower attractiveness than general education but has turned into a mainstream choice at upper secondary level
Standard setting	Often in the hands of specific industry who set their own standards	Centralised control of standard setting with some autonomy granted to vocational schools / regional authorities
Competence based approaches	Only just being established	Now an accepted part of the VET system
The prioritisation of work place and/or work-based learning	While recognised as advantageous in some countries and sectors, also contested by some.	The preferred means of delivering VET in many countries
Skills anticipation	Not much in evidence; piecemeal approaches	Increasingly integrated systems being put in place
Recognition and validation of learning acquired outside of formal education system	Not much in evidence	An integral part of the VET system in many countries
Higher level VET/progression to higher education	Not much in evidence	Still patchy, but an active area of policy development

Source: Cedefop, 2017a, p. 2

As this brief summary shows, VET was historically a school-based system at secondary/upper secondary level, for 15-19 years old students, providing for-employment training, usually referred to as initial VET or I-VET. Today, changes in economic conditions and the labour market, along with changing attitudes towards and provision of vocational or professional education and training (Cedefop, 2017c, p. 24),

has led to a remarkable transformation in public and policy thinking and its role (see Table 2):

- Integrating VET within the wider education system with efforts to establish parity between vocational and academic qualifications, in line with increasing emphasis on employability and graduate attributes/competences across all disciplines;
- Creating a mass participation VET system (where this was not extant previously) such that VET is seen as a key element of the overall education system, including higher education;
- Rationalising VET provision to create more integrated provision, creating a national VET system out of previously fragmented and diverse colleges and institutions;
- Expanding VET provision to adults with more focus on in-employment up-skilling and re-skilling and as part of LLL, often referred to as CVET (continuing vocational education and training);
- Improving alignment between VET provision/supply and socio-economic conditions and context/demand, including rebalancing for-employment and in-employment education and training in the context of changing economic and labour market conditions;
- Viewing VET as part of a continuum of post-secondary educational offerings with qualifications in alignment with the EQF, with clear learner pathways; and
- Adoption of a broader curriculum, pedagogy and assessment practices, combining skills with transversal competences, and supported by appropriate staff development.

As a result, many traditional distinctions between vocational and academic studies, between VET and specific institutional types have blurred. VET is now offered to all age groups, across all disciplines and fields of study, and by all types of educational providers beyond the initial/traditional VET sector and including tertiary education institutions (EQF 5 and above), companies and sectors (Fowler, 2017; Noonan, 2010)

This overview of trends affecting education and skills followed by the resulting changes in the provision of VET illustrates its growing importance for economic development policy making. The next sections will show how skills ecosystems and VET are a crucial yet understated component of innovation, including the latest thinking on Smart Specialisation.

3 Policy and Literature with Respect to the Role of VET in Innovation and Smart Specialisation

3.1 EU Policy Orientations

3.1.1 Vocational Education and Training

A European dimension of education and training was established under the European Coal and Steel Community (ECSC) in 1953 and the European Economic Community (EEC) in 1957. While education was seen as a responsibility of Member States, the Treaty of Rome (1957) included VET. The general principles were laid down in 1963 when the European Council clearly stated that “the common vocational training policy must, in particular, be so framed as to enable levels of training to be harmonised progressively” but progress has been relatively slow as countries have different policies and priorities (Ante 2016). Several actions followed in subsequent decades, including the establishment, in 1975, of the European Centre for the Development of Vocational Training (Cedefop), and the Eurydice education information network and its data bank on education and training in 1981.

Policy began to shift from harmonisation to cooperation, and the importance of establishing equivalences to underpin freedom of movement. EU policy regarding VET has been strengthening over the years. Key policy landmarks are indicated below; see also Box 1.

The *Memorandum on Vocational Training in the European Community in the 1990s* (1991) focused on tackling regional problems arising from skills “poorly adapted to needs for growth and innovation” and brain drain “of the qualified workers and managers needed to develop competitive economic activities” (European Commission, 1991, pp. 4, 7). There was also clear recognition of the links between education and training and strategies for innovation in less developed regions.

The *Copenhagen Declaration* (2002) drew on the experience of Bologna for higher education. It agreed on priorities and strategies for the promotion of mutual trust, transparency and recognition of competences and qualifications in order to increase mobility and facilitate access to lifelong learning. Notably, Member States were urged to use the European Social Fund and the European Regional Development Fund to support the development of VET, and to support the key role of education and training in promoting economic development and social cohesion.

It was followed by the *Maastricht Communiqué* (2004) which more firmly linked VET with the Education and Training 2010 work programme (2001) and subsequently, the *Strategic Framework for European Cooperation in Education and Training* (“ET 2020”). Key priorities emphasized the “political dimension aiming to establish common European objectives and reform national VET systems; [and] the development of common European frameworks and tools that increase the transparency and quality of competences and qualifications and facilitate mobility” (European Union, 2016a). Actions included adoption of the European Quality Assurance Reference Framework for VET (EQAVET), to complement the EQF and the European Credit Transfer System for VET (ECVET) (European Union 2015). The importance of “relevant and high-quality skills and competences for employability, innovation, active citizenship and well-being” were identified (European Union, 2016b).

The *Bruges Communiqué on Enhanced European Cooperation in Vocational Education and Training* (2010) set out an EU 2020 VET agenda. It called on governments to “actively encourage VET providers to collaborate with innovative enterprises, design centres, the cultural sector and higher education institutions in forming ‘knowledge partnerships’, and “to enhance cooperation at regional level”. It was followed by the *Riga Conclusions* (2015) where Ministers committed to “long-term policies through effective investment,

enhanced strategic partnerships and increased cooperation to promote innovation and excellence in VET".

Box 1. Selected Key EU Documents

[Memorandum on Vocational Training in the European Community in the 1990s](#)

Launch of [Copenhagen Process](#) and [The Copenhagen Declaration](#) for enhanced European cooperation in vocational education and training.

[Maastricht Communiqué](#)

[Bruges Communiqué](#) (2010) - "...vocational excellence for smart and sustainable growth." "VET providers to collaborate with enterprises, design centres, cultural sector, and HE in forming "knowledge partnerships"

[Rethinking Education Communication](#) (2012) called on Member States to promote "high-quality dual VET systems, aligning VET policies with regional/local economic development strategies namely for smart specialisation"

[Riga Communiqué](#) (2015) set out the deliverables for European cooperation on vocational education and training for the period 2015-2020

[New Skills Agenda for Europe](#) (2016)

[Strengthening Innovation in Europe's Regions: Towards resilient, inclusive and sustainable growth at territorial level](#) (2017) was the first document dedicated to Smart Specialisation that strongly promoted the role of VET

[Platforms of Centres of Vocational Excellence](#) (2018): Networks of VET institutions will be tasked to link their activities with S3 and cooperate at European level with the support of the Erasmus+ programme.

The *New Skills Agenda for Europe* (2016) sets high targets, bringing together a package of initiatives in three areas: basic competences, visibility and comparability of competences, and labour market and skills intelligence (Europa, 2016a). Critically, it notes the importance of skills to "determine competitiveness and the capacity to drive innovation." VET is identified as particularly valuable "for fostering job-specific and transversal skills, facilitating the transition into employment and maintaining and updating the skills of the workforce according to sectoral, regional and local needs." It also acknowledges that VET is often seen as unattractive; thus, the introduction of higher-level VET provision should be expanded along with greater involvement from business and social partners in the design and delivery of VET to enhance its relevance. This includes work-based learning, apprenticeships, and where possible international experience (European Commission, 2016a).

3.1.2 Smart Specialisation Strategies (S3)

Smart Specialisation is a policy concept that promotes knowledge based development, especially at regional level, through the identification of a limited number of funding priorities (European Commission, 2012b). It was first conceived in sectorial terms in the Commission's Knowledge for Growth Expert Group, and was later adapted to the context of regional development, becoming a key part of the EU's Cohesion Policy. *Regional Policy Contributing to Smart Growth in Europe 2020* (2010), called on national and regional governments to develop Smart Specialisation Strategies (S3) (European Commission 2010b), and the existence of S3 is an ex-ante conditionality for spending on innovation from the European Regional Development Fund (ERDF).

The Smart Specialisation approach has been reinforced in the proposed Cohesion Policy after 2020. As one of the 'enabling conditions', S3 will have to be monitored and implemented much more closely than before. Crucially for VET, a new Specific Objective has been proposed for the European Regional Development Fund, called 'Skills for Smart Specialisation, Industrial Transition and Entrepreneurship'.

Strengthening Innovation in Europe's Regions: Towards resilient, inclusive and sustainable growth at territorial level (European Commission 2017b) identified VET as relevant to supporting innovation with respect to: technological and process innovations; skills and work organization practices; and innovation in low-tech sectors which account for the large share of employment in Europe. Policymakers are urged to "integrate the VET offer into comprehensive skills and knowledge-based economic development strategies, particularly at regional and local level...to attract investments, to clusters, innovation, smart specialization strategies and sustainable growth strategies" (ibid, pp. 38–39).

3.1.3 Linking S3 and VET through Centres of Vocational Excellence

The *Centres of Vocational Excellence* (2018) initiative aims to establish trans-national collaborative platforms of VET providers, together with relevant stakeholders responsible for economic development, innovation and competitiveness policies. The latter may include economic development agencies, regional authorities responsible for economic development, innovation clusters, employment services, skills observatories, business support services, business innovation centres, technology transfer agencies, incubators, as well as key companies, social partners and economic sector representatives. The goal is to encourage regional VET institutions or a cluster of regional entities, in collaboration with local/regional stakeholders, to go "far beyond the simple provision of a quality vocational qualification" (European Commission, 2018, p. 6).

In summary, EU actions regarding VET accelerated in the aftermath of the Lisbon strategy in 2000 which aimed to make Europe "the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion" (European Union, 2000). Education and training is a core part of this objective, especially with regard to promoting innovation and entrepreneurship. From 2010 with the rising importance of Smart Specialisation as an EU policy concept VET has been recognised as taking a potentially key role in providing the skills to support the implementation of regional innovation strategies.

3.2 Selected OECD Actions

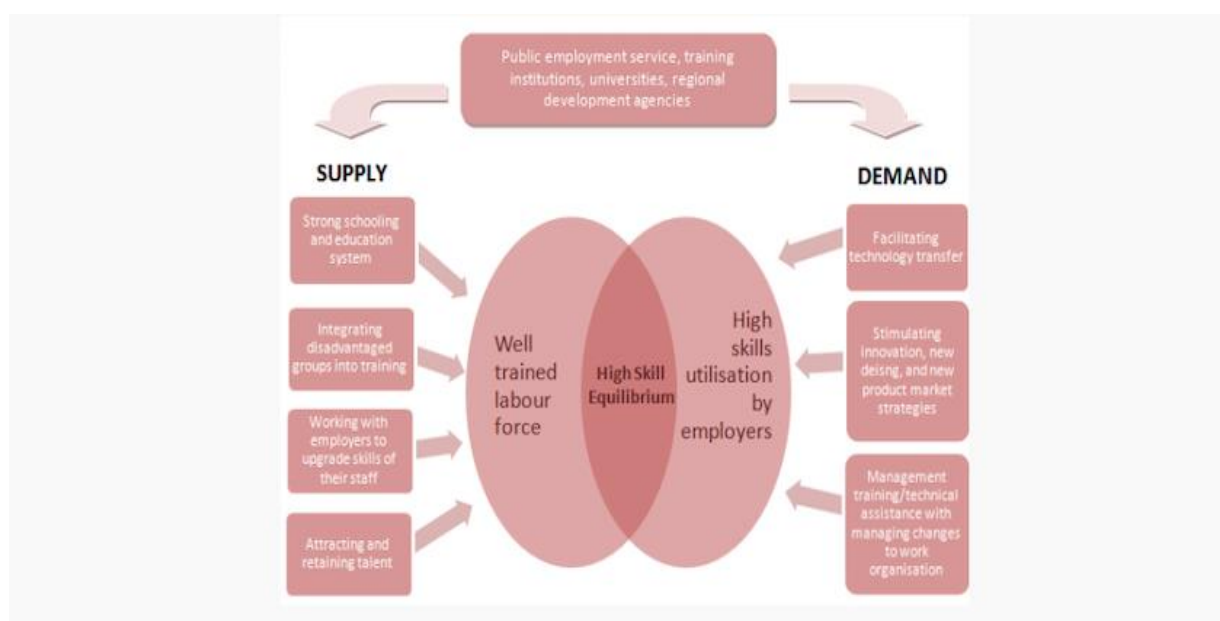
The OECD has focused on the importance of human capital in regions as the means to enhance innovation and economic growth. Successful regions are seen to be those which attract key resources of talent and capital and involve interactions within a network of different actors. Regional core competences, arising primarily from human capital, provide an indispensable basis for identifying opportunities to "pivot" a regional economy.

The Local Economic and Employment Development (LEED) Programme⁴ has led the OECD's work on regional economic development policies, including how skills contribute to innovation and growth. This has focused on the importance of matching supply and demand for skills in local labour markets in order to compete in the knowledge economy (See Figure 2). For example, a project called 'Skills for Competitiveness' designed a diagnostic tool for policy makers to assess skills gaps at local level (OECD 2012). This project found that skills strategies to boost innovation were best developed across sectors within places, rather than focusing only on sectors individually, an approach that is underlined in the literature on Smart Specialisation.

⁴ See webpage for more publications: <http://www.oecd.org/employment/leed/>

When it comes to the role of education institutions, the most notable OECD contribution was under the title of *Higher Education in City and Regional Development* from 2005-2013. Focusing on post-secondary education, the review compared different contributions made by tertiary education institutions to regional economic, social and cultural development, and the important role of partnerships between institutions and regions.⁵ From the perspective of promoting city and regional development, education institutions are a key resource. They can serve regional development most obviously by contributing to a region's comparative advantage in knowledge-based industries and to its human capital base, through educating a wider range of individuals in the local area, ensuring that they are employable when they leave education, helping local employers by responding to new skills requirements, ensuring that employees go on learning by supporting continuous professional development, and helping attract talent from outside.

Figure 2. Linking Skills Development with Demand



Source: OECD, n.d.

Educational institutions can improve the balance between labour market supply and demand. This requires labour market intelligence and sustained links with local businesses, communities and authorities (See example of the AkademijaIT initiative, Lithuania, Box 4). Work-based learning and entrepreneurship programmes can promote links between SMEs and education as well as giving students the appropriate skills to start their own business. Co-operation between institutions can bring numerous advantages including critical mass in competing with other regions, improvement of pathways that involve enrolment at multiple institutions and the sharing of learning through the dissemination of best practice (OECD, 2007, p. 15).

Countries need specific occupational skills in professional, managerial and technical jobs, in expanding fields such as health care, as well as in traditional trades like electricians. VET systems which supply these skills are now under intensive scrutiny to determine how they can best deliver the skills required, ensuring that they adapt to fast-changing needs⁶. One of important reasons for this is that work-based learning has been neglected or insufficiently developed (OECD, 2014, p. 57). Thus, the main issues to be advanced include:

⁵ OECD (2005-) Project on supporting the contribution of higher education institutions to regional development.

⁶ OECD Policy Reviews of Vocational Education and Training (VET) and Adult Learning. See <http://www.oecd.org/education/innovation-education/vet.htm>

- Leveraging vocational education to integrate students into the labour market;
- Many professional & technical jobs require no more than 1-2 years post upper-secondary;
- Main challenge is improving the quality of vocational training while also changing perceptions about these programmes;
- General academic pathway continues to be regarded as “prestige” path, with vocational routes considered second-best; and
- Developing and promoting apprenticeships critical to changing image and ensuring programmes provide equitable access and outcomes to students.

Apprenticeships can be a key tool of economic development as well as social integration by combining workplace and classroom-based learning. While systems vary considerably across the OECD, good practice examples are found in those countries which operate a dual-education, since they can provide pathways for students to move from training into work. Even in countries with less formalised systems, apprenticeship training can work well on the basis of strong networks with SMEs and incentivising participation. Collaboration between education providers, employers, civil society, government actors from all levels, as well as young people themselves are vital. Educational institutions need to incorporate more flexible learning modes and pathways to meet the changing demands of a more diverse educational cohort (OECD, 2017).

3.3 Vocational Education, Innovation and Smart Specialisation

3.3.1 Innovation systems

To be competitive in a globalised economy, countries need to invest in their innovation systems at the national and regional level. While there has been considerable improvement in the quality of life nearly everywhere over recent years, “income and job opportunities remain concentrated in large cities and certain regions” (OECD, 2018b, p. 10). Yet, remarkably, the role or importance of education, and specifically VET, does not feature to any great extent in either the academic or policy literature about regions and innovation. Instead, too much attention has been placed on new knowledge production as the generator of innovation and too little on the importance of human capital as the key underpinning agent of innovation systems.

The innovation literature has tended to overemphasize the role and effectiveness of university-based R&D, to emphasize knowledge creation rather than knowledge diffusion and exploitation, and to prioritise research universities over other types of educational institutions and opportunities. The emphasis has been on building capacity through strengthening research rather than through human capital (Foray, 2017, 78-79). This approach has been strengthened by the metrics used by international league tables which prioritise global excellence rather than national or regional significance, and thus as a consequence is contributing to regional impoverishment with economic, social and political consequences (Hazelkorn, 2015, chapter 6). While “multinationals are very strategic in their location decisions”, SMEs “lack the same capacity” yet they are key to regional innovation (OECD, 2013, p. 45).

Accordingly, insufficient attention has been given to the most important resource – people, without whom it is impossible to close the regional disparity gap. There is a huge inter-dependence between economic growth and innovation, and knowledge and skills, the latter of which derive from and depend upon people with skills relevant to regional and national economies.

[There is a] danger in focusing *only* on those innovations concerned with a small number of high-technology sectors as contributors to economic growth. The benefits of innovation

to the ... economy also come from ensuring that new technologies and work processes are adapted widely throughout all sectors of the economy (Curtain, 2004, p. 6).

This includes developing, retaining and attracting people of all abilities, recognising that process, product and social innovation can be equally if not more powerful than technological innovation. Furthermore, SMEs and traditional industries are vital for sustainability in towns and cities outside the main metropolises and neglecting them can lead to geographical discontent (Rodríguez-Pose, 2017). Recent years have witnessed growing regional disparities across and within member states creating “left behind places” accompanied by social-cultural and political fissures across developed economies (Baron, Kantor, & Whalley, 2018; Brinkley, 2008; Goldsmith, 2018; Goodwin & Heath, 2016).

3.3.2 Smart Specialisation

Smart specialisation is about regional economic transformation. Going beyond research-oriented activities, VET can play a critical role in innovation because the absorption of know-how (or absorptive capacity) contributes to a shared pool of knowledge in society which is an important factor for sustainable and equitable growth (Salter & Martin, 2000; Mowery & Oxley, 1995). The speed and direction of absorption is shaped by well-educated and trained people. Most critically, the “primary source of productivity growth is technological readiness and innovation, which in turn requires a well-educated and skilled workforce” (BIAC, 2008).

Lundvall and Johnson (1994, p. 27-28) identified four types of economically relevant knowledge: Know-what refers to the knowledge about “facts”... close to what is normally called information...Know-why refers to scientific knowledge of principles and laws of motion in nature, in the human mind and in society...Know-who refers to specific and selective social relations... to know who knows what and can do what...Know-how refers to skills – i.e. the capability to do different kinds of things on a practical level. “Know-what” and “know-why” can be marketable commodities, while “know-who” and “know-how” generally cannot be removed from their social and human context (i.e. region)(Kearns, Bowman, & Garlick, 2008, p. 6-7).

Table 3: Emphasis and Omissions in RIS3 Policies and Literature

Emphasis	Omissions
<ul style="list-style-type: none"> • Knowledge creation • Supply-side • STI model • Universities & RTOs • High-tech industries and large companies • Investment and financial markets • Researchers, PhDs, managers, engineers • The region 	<ul style="list-style-type: none"> • Knowledge diffusion & exploitation • Demand-side • DUI model (Doing, Using, Interacting) • KIBS and VET centres • Traditional industries and SMEs • Labour force and labour market • Intermediate and technical qualifications • Multi-level & local systems

Source: Navarro, 2018

Innovation is also more than technology. It includes social innovation in the organization of firms and production, as well as financial innovation creating value in firms brought about by well-educated and trained staff. Accordingly, investment in high quality upper-secondary and higher-level vocational education and training are extremely important factors in explaining the innovativeness of high cost countries (Lundvall, 2002).

The education system, including VET and research universities, has often been slow to anticipate or respond to changes in the economy and labour market. There is an absence of good strategic intelligence or forecasting models, and often a proclivity within education, especially higher education, that it should not align itself too closely with business and the economy. Priorities are usually set by the institution, based upon teacher/academic competences, interests and priorities which are not always well aligned with the (changing) socio-economic context and not easily changed due to contractual issues. There has also been an absence of mechanisms or forum by which an agreed vision for a region can be discussed, agreed and implemented. In developing S3, depending upon the country, VET (as well as HE) has not been involved in the discussions or even been aware of such discussions or even the concepts (Navarro & Retegi, 2018).

3.3.3 The role of VET institutions

Vocational education institutions, including universities of applied sciences (UaS), have a distinct role with respect to innovation which differs from that of research universities which may also offer vocational or professional educational programmes. However, they are often an untapped resource for innovation.

Research in VET institutions is often underdeveloped, reflecting disagreement about their role and extent to which VET should be active players in the research arena, and if so, the orientation of that research (for example, compare Moodie, 2006, Curtain, 2004 and Beddie & Simon, 2017). While VET institutions often have a remit to enhance economic development in their community/region, they are often seen (too) narrowly as simply providing skills education rather than a more extensive role as a key part of the innovation eco-system. Thus, it is argued that VET institutions could have a more...

"...direct role in promoting and diffusing smaller scale innovations focused on processes and development rather than the sector seeking to engage in pure research. This would enable the VET sector to diffuse business innovation and enhance its links with business, particularly with small and medium-sized enterprises in general and especially those in regional areas." (Curtain, 2004, p4)

Others suggest:

"There is an opportunity for the VET sector to be a contributor to the innovation system through an applied research agenda. In this context, applied research refers to research with a focus on solving real-world problems. Through its ties to industry, VET can play a role in translating this knowledge to the workforce" (Beddie & Simon, 2017, p. 3)

In either case, there is a more expansive role for VET institutions in the regional eco-system which involves adopting the principles of smart specialisation to their own work – developing a strategic place-based approach to curriculum design, adding comparative value to the regional economy by developing programmes which build on local expertise, products and needs. This includes, inter alia, broadening partnerships with local business, service providers and industry associations, and establishing a network of vocational education institutes.

VET institutions can have a key position with respect to encouraging and facilitating the diffusion of knowledge to help what is called the "transformation of practice" to generate economic development (Moodie, 2006, p. 134). Just as universities work with professional bodies to develop the knowledge base of practice, VET institutions can play a similar role with different vocational fields, from business administration to child education, construction to design, and tourism to IT services. This means that VET institutions can help develop, codify and institutionalize the knowledge base of practice; this should be explicit and built into their role.

Furthermore, VET institutions can affect curriculum and pedagogical practices given their discipline specific expertise, in other words bringing practice directly into their teaching. For example, the teacher of apprentices can bring insights from engineering directly into shaping the changing work of electrical trades' apprentices. Similarly, teachers of aged care workers can consider integrating new health research (e.g. Alzheimers) into the career preparation of care workers. Finally, the digital transformation could be included horizontally in all VET programmes, given the impact it can have on productivity. Compared to university academics, VET teachers are often better placed to integrate practice into teaching because they are more likely to have had the practical experience themselves. It is also one of the key reasons why VET teachers need higher education qualifications that include emphasis on the scholarship of teaching and learning.⁷

Box 2. VET and innovation across the world

Countries have tackled the issue of VET, applied research and innovation in different ways. The Canadian and Dutch governments for example have invested heavily in building applied research capacity in VET to stimulate commercial partnerships with SMEs, while the UK government has invested in building scholarship in the further education sector primarily to enhance teacher capability and student learning. In Australia, TAFE institutions are starting to yield impressive results for institutes and their industry partners. In Germany, investment has led to over 150 highly successful spin-off companies and recognition of Fachhochschulen in Germany's innovation system, which is similar to the experience in Ireland with the institute of technology sector; the latter are currently undergoing a rigorous process of re-designation as technological universities

Sources: Victorian TAFE Association (2018), Kyvik and Lepori (2010)

⁷ Leesa Wheelahan, Centre for the Study of Canadian and International Higher Education, University of Toronto. Correspondence with author.

4 Discussion and Analysis

4.1 Analysis of Issues and Key Messages

This section discusses some of the key messages and issues arising from the literature and specific regional cases. All the issues have direct implications for human capital development, and the successful integration of VET into S3.

4.1.1 Governance of education systems and links to innovation

Like with governance of smart specialisation, governance arrangements for VET institutions vary across Member States. There is usually a division of responsibilities between different ministries/agencies and between central and local/regional administrations, with different levels of autonomy according to type of institution, with separate roles for private training providers, employers and trade unions. Many countries have separate governance arrangements for vocational schools and colleges, universities of applied sciences and research universities reflecting different roles and missions. Vocational education institutions, and to a lesser degree universities of applied sciences are more likely to be governed by local and regional authorities. In contrast, research universities usually come under the responsibility of central government or a buffer organisation; they are more autonomous and encouraged to be strategic, ambitious and innovative. According to the OECD, “decentralised governance has advantages in terms of diversity and innovation, but it may confuse students and employers, involve some duplication of tasks such as curriculum design, and complicate transitions” (OECD, 2014, p. 46). It can also create variations in provision and prevent the education system adopting flexible learning pathways, which can enable learners to move across and through the system at ease in order to meet changing needs or life-opportunities.

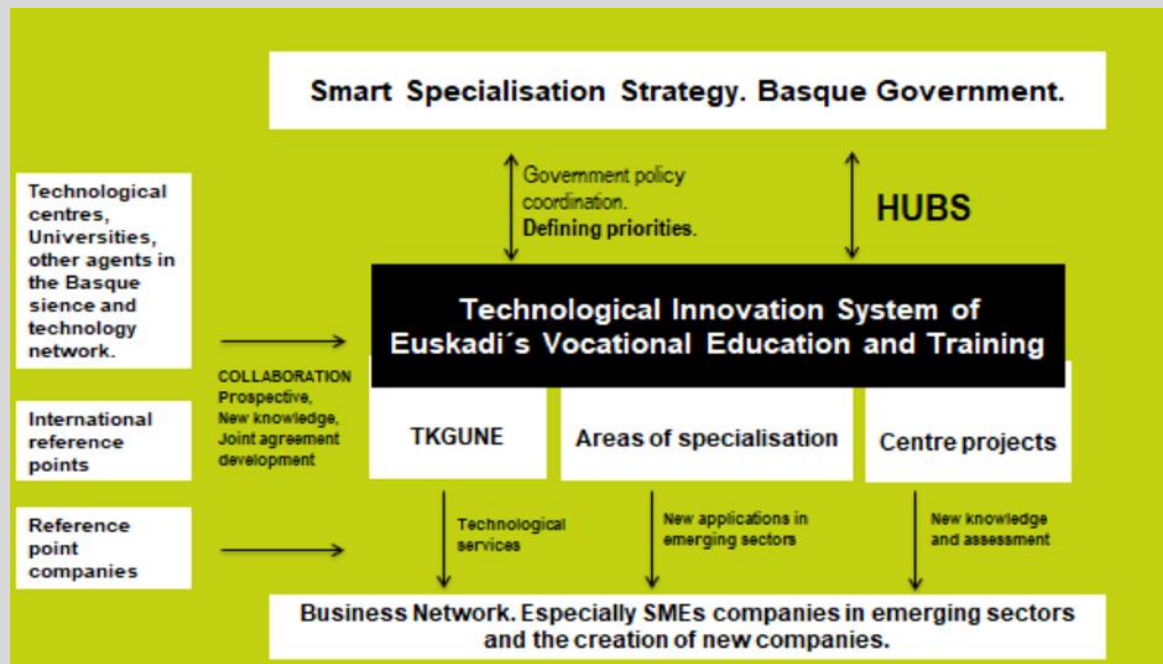
The lack of cohesion can also be a problem within institutions. For instance, engagement between programme development/design and external stakeholders is often assigned to a particular unit or individual. This is understandable given the need to assign management roles and responsibilities, but it can lead to the relegation of engagement to a silo of activities or individualised initiatives rather than the adoption of a coherent and sustainable strategy (Goddard, Hazelkorn, Kempton, & Vallance, 2016).

To overcome this fragmentation, there has been growing emphasis on the importance of collaboration, within the education system and especially across the post-secondary system (Alvey, 2018). To this end, governments have begun taking a system-approach to consider how best education might best be structured and governed to optimal effect. Some have more systematically integrated VET across levels of education and enhanced connectivity between VET and higher education/universities; this is exemplified by Norway in 1994 and by the Netherlands in 1996. The intention is to focus on increasing capacity where necessary, extend coverage and connect hitherto fragmented provision. There have been similar efforts to introduce a single governance structures for the whole post-secondary system, such as Wales, Scotland and New Zealand, and to enable greater transferability and coherent learning pathways (Hazelkorn, 2016; James & Unwin, 2016).

Box 3. Basque Country's Vocational Education and Training System

Establishing and maintaining the Basque VET Ecosystem is a top political priority. It comprises the Basque Government Education and Economic Development and Industry Directorate, economic and social partners, VET centres, as well as teachers and students. Aligned with the Basque Smart Specialisation Strategy, the emphasis is on VET Excellence, with an integrated approach to training, applied innovation and active entrepreneurship. Internationalisation is a transversal component.

The strategy, which links firmly with S3, puts sustainable human development at the centre. Accordingly, VET sits at the centre of the Technological Innovation System. The objective is to help guide Basque applied innovation, bringing together 19 centres in 4 hubs organised around priorities: advanced manufacturing, digital and connected factory; energies, and biosciences and biotechnologies. There is strong co-operation between VET and SMEs in the provision of services, the aim of which is to provide high-level specialist support going beyond simply the provision of training. Working in this way creates a sustainable innovation centre of excellence.



Source: Government of the Basque Country (2018)

Governance cohesion needs to extend beyond the education system itself. The OECD has called for stronger interactions between the world of work and the world of education and training. This requires policy coherence through a whole-of-government and stakeholder engagement approach, because the solutions extend beyond VET (OECD, 2016a). The EU, as part of its *Agenda for New Skills and Jobs* supported the idea of European Sector Skills Councils (European Commission, 2010a). This has been built upon in the Skills Agenda for Europe leading to the Blueprint for sectoral cooperation in skills (European Commission, 2017d), which is funded by various sources including Erasmus+ and COSME. The link with S3 is explicitly made, with one of the three tasks to implement the blueprint being to establish "business-education-research partnerships on the ground, including in the context of smart specialisation" (ibid, p5). Many Member States already have a long tradition of engagement between employer and trade union organisations and VET, notably Austria, Denmark and Germany. Similarly, Ireland has recently established Regional Skills Fora as a mechanism to bring VET and HE together with employer and business groups, and government agencies, to better co-ordinate education responses to regional needs (OECD, 2014).

Finally, alongside efforts to increase institutional autonomy, governments have introduced accountability measures. This may be part of performance funding or compact systems, with funding dependent on an institutional response to national objectives, including labour market needs (Bjornavold, 2017). In Ireland, institutional compacts have until now only been a feature of "negotiation" between the Higher Education Authority and the universities; it is now being extended to the further education/VET system.

As noted in section three, there is little evidence of VET institutions being systematically integrated into S3 governance structures. Experience studying the role of HE institutions shows that their involvement has often been at senior manager level. Regional authorities have found it difficult to engage HEIs in the design and implementation of S3 in terms of their human capital contribution, while research intensive universities have often used such governance structures to lobby for increased spending on research in their particular specialisation (Kroll, 2016; Edwards et al, 2017). The difficulty of harnessing the potential of HEIs across all their missions is partly because of silos between research and teaching, relating to the problem of internal cohesion highlighted above. It is also a result of funding structures, both at EU and Member State level that reflect these silos, separating calls for research and human capital and not integrating them in governance structures.

It is likely that the same reasons also explain why VET institutions have been left out of S3 governance, given that the implementation of the strategies is only technically related to Thematic Objective 1 of the ESIF. However, there are examples where regions have followed the call to integrate S3 policy mixes (European Commission, 2012b) and governance structures (European Commission, 2016b). One such example is the Basque Country where the hubs established for the S3 priorities to carry out a continual process of entrepreneurial discovery include representatives of the VET system, notably TKNIE, the Basque agency responsible for linking VET with innovation⁸ - as explained and illustrated in Box 3.

4.1.2 Curriculum and Pedagogy

The Bologna (HE) and Copenhagen (VET) processes introduced the concept of clearly articulated learning outcomes, which now feature strongly in curriculum development and assessment across Europe and elsewhere. Focus on learning outcomes has shifted the emphasis from inputs to outcomes and the quality of the learning experience (Hazelkorn, Coates, & McCormick, 2018). As Kuh and Jankowski (2018, p. 306) note:

"What students know and are able to do will determine their future prospects more than at any time in history. It is this profound relevance and worth of postsecondary education that adds a measure of urgency for adequate quality assurance mechanisms that produce information that institutions can use to enhance student performance and attainment along with institutional effectiveness."

Research shows that students learn best when activities "induce students to apply their knowledge and skills to a specific set of desired tasks or problems and demonstrate their level of proficiency at doing so" (Kuh & Jankowski, 2018, p. 308). Lundvall (2002) similarly stresses the importance of interactive learning as the basis for innovation. Accordingly, work- and practice-based learning – part of the wider competence movement - which was traditionally associated with I-VET, is increasingly included in many post-secondary and university-level programmes, e.g. work experience, internships, apprenticeships, work-learn programmes (Kis & Catriona Windisch, 2018, p. 11, 34); the precise nature of the concept varies between levels of education. Critically, the emphasis on skills is matched by growing understanding that people also require a wider range of competences; technical skills alone are no longer sufficient in a rapidly changing world.

It is often said that we are in the "early stages of a learning revolution" involving new teaching and learning pedagogies (e.g. problem-based learning and students as co-creators), and the use of technology in classrooms (e.g. virtual learning environments, adaptive learning, immersive environments, mobile learning, and flipped-classrooms). MOOCs – massive open on-line courses – are changing delivery modes and facilitating access to students for whom the constraints of the traditional/standard experience (time, location, cost, etc.) pose a barrier to entry.

⁸ See: <https://tknika.eus/en/who-we-are/>

As the education system expands to meet the needs of more and diverse learners, there has been an “unbundling” of aspects of the education experience so that students can tailor their entry, exit, assessment and qualifications to their personally determined needs, rather than being required to fit a standardised mould. This may include flexible modes of learning, including part-time and modular arrangements, distance learning and competence-based approaches. Credit-accumulation and credit transfer arrangements, sometimes referred to as stackable qualifications, allow learners to study selected parts of a programme over time, and often in different locations, as a way to undertake their qualification or upgrade skills. System level arrangements are less common, but many VET institutions have established bi-lateral arrangements with universities, and vice versa. These developments represent a significant shift from traditional time-served practices (e.g. qualification based on 2, 3 or 4 years) to competency-based education – in response to demand rather than supply.

Box 4: AkademijaIT initiative, Lithuania

ICT has been a key driver for economic transformation in Lithuania; it is an S3 priority and a significant component of other priorities, such as transport, health and energy. However, a combination of the global credit crunch, low internationalisation, emigration and a low share of ICT professionals in the labour pool created a perfect storm of difficulties – demand with insufficient supply. The expansion of ICT programmes by the universities proved to be too slow. In addition, there were insufficient students transitioning from secondary school into ICT fields of study.

VET was an untapped opportunity. Akademija.IT was established to respond to the challenges of the labour market. New regulations were introduced which allowed for fast-track modular programs in formal VET, with duration of 10 months or 60 ECTS, of which more than 60% is practice- and work-based learning. There is a close working relationship with key stakeholders. Other positive impacts include second-chance job opportunities, and graduates with considerable interdisciplinary skills relevant to the RIS3 strategy. Alumni from the programmes are especially loyal, forming an important world-wide network.

Akademija’s success has helped reduce labour market demand-supply mismatch and maintain relevance to regional strategy with a potential to provide 25-30% of total graduates to the Lithuanian ICT sector.

More info: <http://akademija.it/>

Competency-based education (CBE) is a movement largely limited at present to the USA, although the concept is well understood in vocational education (High-Level-Group, 2003; Voorhees, 2011, p. 5). CBE provides a way by which a learner’s demonstrable competencies (which can include knowledge, skills and attitudes) can be assessed rather than a record of classes attended or time taken. In this way, CBE seeks to offer a much more flexible approach that will support adult, part-time and mobile learners (Weise, 2014). Similarly, recognition of prior learning (RPL) involves novel ways to assess what a person has already learned through other modes of learning and life-experience.

The concept of lifelong learning (LLL) stresses that “*learning throughout life is a continuum*” (AGE, 2007). This requires greater cohesion across levels of education, with more attention being given to developing coherent and integrated educational and learning pathways between parts of the system (Wheelahan, Buchanan, & Yu, 2015). In Europe, the qualifications frameworks (EQF) provides signposting for learning pathways and articulated frameworks which are understandable and beneficial to both students and employers (OECD, 2014b, p. 98-101); this is underpinned by the ECVET system (European Credits for VET) which can be further developed to enable students accumulate credentials over time, and enable mobility and learning opportunities (Williams et al., 2015, p. 27). Greater system flexibility enables learners, of all ages, to

move in and out of the education system as labour market and life circumstances changes (Dougherty et al., 2017).

4.1.3 Adult Learners

Expanding educational opportunity has focused primarily on facilitating the transition of more 18-year olds⁹ into tertiary education. Participation rates have risen accordingly over recent decades. But demographic changes across the EU, and other developed economies, means that the relative importance of adult learning to the workforce is increasing. In addition, as people live actively for longer (Jagger, 2015), there is a necessity to expand learning opportunities to cater for re-skilling and up-skilling requirements for people in the labour force or for those wishing to (re)join. The latter is especially significant for women after child-birth or -raising. Overall it is increasingly recognised that adult learning is no longer an optional extra, but essential to meet skills needs. Furthermore, beyond the economic argument, education underpins democratic societies that rely on informed citizenship.

In the US, the most significant development in higher education has been the massive growth in the adult student population; the “new traditional” student is fast becoming the dominant component of the student population. Approximately 40% of students are 25 years or older, and 58% are 22 years or older (Stokes, n.d.; Soares, 2013; Hess, 2011). Across the OECD, more than 50% of adults participate in formal and/or non-formal education in a given year (OECD, 2014b). According to Eurostat, Australia, Belgium, Finland, Iceland, New Zealand and Sweden show significant shares of their adult populations, particularly adults who are 40 years and over, participating in education; in Sweden and Luxembourg this rises to over 70% (European Commission/EACEA/Eurydice, 2016; Eurostat, 2015). This is explained by larger part-time enrolments and/or by lifelong learning programmes in these countries (OECD, 2014b, p. 306). However, the figures are even higher when non-formal education is taken into account, which is significantly larger than formal participation (European Commission 2018).

Changes in the age cohort of learners has implications for the education system more broadly. Adults are more likely to choose non-formal vocational programmes or to choose programmes which better co-ordinate with their family and life circumstances, such as part time or distance learning (the extent of which however is not yet formally reported). In 2011, 36.8% of the EU-28’s adult working-age population participated in non-formal education and training, which was almost six times higher than those in formal education or training (6.2 %) (Eurostat, 2015). In other words, the majority of adult education and training occurs in informal or non-formal situations rather than in formal education programmes which carry a recognisable credential – which effectively means that adults are not being given sufficient recognition of the study they have undertaken.¹⁰ There are differences across the EU and an EU-funded project seeks to have informal and non-formal qualifications recognised within the EQF and national frameworks (Dębowski et al., 2018).

4.1.4 Widening Access

VET has played a key role in broadening access to, and participation in, education and training. The challenge is to reach out to people and communities who may be the first-in-their-family to consider attending either VET or higher education or who feel so deeply alienated from society that even completing secondary level education is not within their

⁹ The precise age of completion of upper-secondary programmes does differ across/within countries

¹⁰ Formal Education refers to the regular education and training system where courses are of a predetermined purpose and format, provided in system of schools, colleges, universities and other educational institutions, and is recognised by a national authority. Non-formal education refers to all organised learning activities outside regular or formal education, including courses or seminars to acquire/improve skills, knowledge and competence aimed at improving job-related knowledge or enhancing skills for social and personal purposes. It may however be provided by institutions that offer formal education programmes.

thinking. Despite decades of initiatives, research continues to show how socio-economic characteristics, rather than merit, track students through the education system and into the labour market (Crawford et al., 2016).

As we enter the 4th industrial revolution, shortages of people with good knowledge and skills in key areas of economic activity are becoming evident. While EU member states have made good progress towards the goal of increasing the share of the population aged 30-34 having completed tertiary education to at least 40% by 2020, about one-fifth of 15-year olds show insufficient abilities in reading, maths and science – a backward step compared to 2012 (Eurostat, 2018a). At the same time, 17.2% of 20-34-year olds were neither in employment nor in education and training (so called NEETs) in the EU in 2017; the proportion of NEETs ranged from 7.8% in Sweden to 29.5% in Italy (Eurostat, 2018b). This represents deep reservoirs of talent to be tapped, which often coincides with economic and social disadvantage. VET has a particular role and social responsibility to work with such communities and to develop strategies and pathways by and through which people of all abilities, ages, ethnicities and talents can be guided to reach their full potential and contribute their skills, energies and commitment to wider society throughout their lives. This requires much deeper engagement and sustained commitment to these communities.

Box 5. VET and the Automotive Industry in Västra Götaland, Sweden

The Swedish automotive industry is concentrated in the Västra Götaland region. The landscape of the automotive industry has changed, and today cars, trucks and buses are more similar to high-tech computers or cell-phones on wheels. Industries need people with the appropriate skills to maintain the region's knowledge base and enable the industry to grow to its potential. At the same time, the region and industry are facing a demographic challenge; the staff are ageing and fewer young people are choosing to go into the sector. Twenty-three percent of employees in the automotive industry are women. In the future, the industry will require people with higher qualifications, but the education system has in the past been too slow to meet its requirements, and there was been previously little interest in VET.

However, a number of initiatives have been developed to increase interest in the sector, including encouraging dialogue between universities and other educational organizations, and close collaboration with SMEs. This has involved working with the regional competence councils and supporting the development of Gothenburg as a technology development testbed.

4.1.5 Skills Utilisation and Skills Ecosystems

The focus of skills policies is usually on the supply side; as the OECD has commented, policy attention has primarily been on increasing the stock of available skills through education and training, migration and activation. However, more skills are not necessarily better skills, and the mere existence of skills does not automatically lead to improved economic performance (OECD, 2011, p. 19).

According to Keep, skills utilisation cannot be tackled independently from industrial policies and business development (Keep, 2016). In other words, skill supply cannot be considered or addressed separately from demand. This includes not only an assessment of current and future demand, and socio-economic and labour market conditions, but also in the context of actions required to stimulate demand or absorptive capacity. Skills utilisation has largely been a hidden issue because of the policy assumption that employment opportunities were available. However, this has not always happened, with the result that there has been considerable discussion around under-employment (Mcguinness, Whelan, & Bergin, 2017); while skills mismatch and/or underemployment can be a feature of economic recession it can also be the result of poorly aligned strategies at the regional or institutional level. There are also specifics about which skills

for which labour market, and these cannot be “solved by simply increasing skills supply via VET or higher education, but instead were symptoms of wider problems with the attractiveness of the employer and/or occupation” (Keep, 2016, p. 29).

This discussion has implications for VET and smart specialisation because it points to the role of VET as more than a supplier of skills but as having a more extensive role in helping to build and generate absorptive capacity. The concept of a skills ecosystem has evolved overtime, but essentially it demonstrates that skills supply relates to a complex set of intertwined issues, including the structure of labour markets, the attractiveness of certain kinds of work, patterns of recruitment and selection, and poor deployment of labour. By taking a wider approach and linking skills with innovation and regional policy, it is clear that innovation occurs in all types of economic activity, from low to medium and high tech, and thus is not always or only associated with “high-skill research scientists, R&D staff, knowledge experts and senior organisational and production managers” etc. (Keep, 2016, p.34).

The key point is that innovation is more diffuse than something being handed down by research universities and company R&D departments. As Lundvall et al (2002, p19) note:

"One of the interesting aspects of the Danish system is that its relative wealth has been built in spite of a specialisation in low technology sectors and that most of its innovations are incremental and experience-based rather than radical and science-based. Supporting innovation in low technology areas will remain an important priority for industrial policy. In the light of the "new economy" discourse there might be a risk to forget about the renewal of competence in traditional sectors, including service sectors"

Furthermore, incremental and 'learning by doing' innovation also happens in high tech sectors, as does the need for diffusion and adoption of technologies, all of which would benefit from the types of skills developed by VET. The implications of this discussion present huge opportunities for VET to play a much more significant role in the innovation eco-system than might previously have been considered.

Box 6. iWatermap: Interregional Cooperation, Netherlands

CIV Water or Centre for Innovative Craftsmanship Water is a knowledge centre for VET. It is a collaboration between business and schools to inspire (young) people to a technical career in water. It is focused on developing the talent of future and working professionals, and creating new innovative education together with knowledge workers, industry and school teachers. It considers itself to be a place for business “in the driver seat”.

The rationale for CIV came from the realisation that many experienced professionals were retiring. The aim was to prevent a brain drain, to ensure that VET was up-to-date and future proof, and to update professionals. The centre works by building a bridge between VET and applied science education, and to translate new developments in the water sector into new education. CIV is a facilitator of the co-creation of knowledge, bringing knowledge workers together with schools.

5 Conclusions and Policy Recommendations

This report has reviewed a wide range of issues influencing the role of VET in smart specialisation strategies. While VET has traditionally been viewed as a significant part of secondary/upper secondary education, it is increasingly a core component of education provision at all levels. However, the important point is not at which level VET is delivered, but what role VET can play in supporting diffusion of innovation, providing relevant skills for industrial development and overall supporting local/regional innovation ecosystems.

In summary, the key messages emerging from this discussion are:

- Focus on human capital is fundamental to the sustainability of the regional innovation eco-system. Accordingly, VET has a strong capacity to deliver and play a major role in smart specialisation strategies: helping retain and attract talent, generate absorptive capacity in the societies and economies in which they are located, and to help build sustainable more equitable communities;
- Increasing collaboration between different parts of the education system, schools, VET and research universities, enterprise and civil society are key to ensuring that the regional networks are strong; neutral regional brokers including VET institutions have a key role to play in strengthening these ties as well as through joint projects and sharing facilities;
- VET curricula should be outcome-oriented and responsive to the labour market – balancing supply and demand, and widening the opportunities for learners of all abilities, ages, ethnicities and race to live successful and sustainable lives;
- Changes are required in the way in which VET and other educational providers organise curriculum in order to enhance and widen participation to a more diverse student cohort, including adult learners;
- The formation of regional innovation clusters comprising education and research institutions can help generate critical mass and nurture social ties with other parts of the public sector and with business and the community to maximise the use of available resources;
- Leadership capacity is required across all partners with the ability to create a shared vision for the future.

Table 4 highlights the key enablers for success as well as identifying some of the main barriers. There is however, much more work to be done in bringing VET to the attention of policy makers and practitioners in the field of innovation and smart specialisation, as well as the field of local and regional development more broadly. At EU level there are a number of recommendations that can be made including:

- Increase the awareness of innovation and the smart specialisation approach within the ET2020 agenda, stressing the importance of working across government to enlarge the policy mixes of regional innovation strategies.
- Make the most of centrally managed EU funding programmes especially the Erasmus+ funded Platforms of Centres of Vocational Excellence, Sector Skills Alliances and other Key Action 2 and 3 programmes to increase dialogue and cooperation in using VET to boost innovation in regions.
- Promote the use of VET for innovation within the ESIF, in particular during the programming stage for the multi-annual framework post 2020, both from the ESF and the proposed ERDF specific objective on Skills for Smart Specialisation, Entrepreneurship and Industrial Transition.
- Promote cooperation between VET institutions and their representatives and managers of S3. At EU level this can be done through raising awareness in the S3 Platform, including the thematic platforms and the targeted support to S3 implementation.

Table 4. Enablers and Barriers Driving the Role of VET in the Innovation System

Enablers	Barriers
<ul style="list-style-type: none"> • Training young people to meet the needs of intermediate and high-level technical qualifications; • Increasing necessity to update and requalify adult population as people live longer and actively; • Providing SMEs with technical and innovations services, especially those not based on R&D; • Supporting entrepreneurship and business incubations skills in companies and in the population; • Linking vertically and horizontally with other sections of the education system, and providing an educational bridge for learners throughout their lives; • Designing place-based curriculum and aligning skills development to demand at the local level, with particular emphasis on thematic or vertical priorities; • Focussing school, vocational and higher education curricula on transversal competences like creativity, entrepreneurship and initiative to help young people develop their full potential for innovation; • Governance arrangements which emphasize regional cohesion and collaboration; • Increasing attractiveness of VET and the role it can play with respect to innovation and smart specialisation. 	<ul style="list-style-type: none"> • Lack of coherence between national and regional/local policies; • Absence of VET in discussions, decisions and implementation of RIS3 strategies; • Failure to align VET programme offering with social/regional needs, e.g. an imbalance between supply and demand; • Insufficient attention given to ensuring qualifications and programmes adequately anticipate future skills needs to reflect technological and structural change in the labour market systems; • Ensuring teachers possess sufficient knowledge and have appropriate facilities and technologies to support the educational programmes; • Lack of political and institutional leadership; • Weak governance structures, with competing and conflicting demands from different levels of government and government strategies; • Absence of shared vision for regional growth and sustainability; • Weak VET applied research capacity and capability, with the absence of appropriate and corresponding support for teachers/academic staff; • Lack of appreciation about the importance and value of VET by the public, students and parents, and policy.

Source: Authors

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